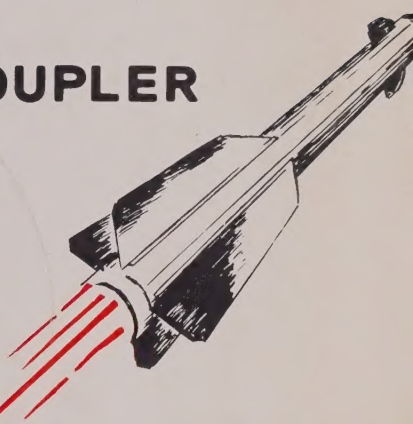
M-406

INSTRUCTION BOOK

FOR

MODEL PM-406

PREAMPLIFIER-MULTICOUPLER



NEMS CLARKE CO.

919 JESUP BLAIR DRIVE • SILVER SPRING, MARYLAND

A DIVISION OF Vitro CORPORATION OF AMERICA

AHFECN1326&1471

ADDENDA
TO
INSTRUCTION BOOK
FOR
PREAMPLIFIER-MULTICOUPLER, MODEL PM-406

1. A review of the design of the Preamplifier has indicated that an improvement of the units' performance may be achieved by the use of a 2-1/16 inch length of #22 bus wire instead of coil L-106. Accordingly, PM-406 Preamplifier-Multicoupler bearing the following serial numbers have this bus wire in lieu of the inductor: 104, 105, 114, 115, 119, 123, 127, 153, 204, and 231. All Preamplifier-Multicoupler units bearing serial numbers higher than #226 have this modification. No change on the schematic is needed as the length of #22 bus wire is now the coupling inductance and is labeled L-106. The description of L-106 in the parts list of the instruction manual should read as follows:

L-106 INDUCTOR: 2-1/16 inch of #22 bus wire

2. In order to achieve longer tube life of the 6280/416B Planar Triode, resistor R-109 is changed from 5.4 Ω to 6.2 Ω ±3%, 25 watts. This modification is applicable to all units and replacements ordered for this resistor should specify the larger value. Change the schematic and the parts list to conform to the following:

R-109 RESISTOR, WIREWOUND: 6.2 Ω ±3%, 25W, Dalohm RH-25.

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NEMS-CLARKE COMPANY
919 Jesup Blair Drive
SILVER SPRING, MARYLAND

A Division of Vitro Corporation of America

AHF5316061559

WARNING

This equipment employs voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised while operating this equipment with any of the protective covers removed.

TABLE OF CONTENTS

Paragraph Page

SECTION 1

GENERAL DESCRIPTION

1-1. Purpose of Equipment 1

1-2. Description of Equipment 1

SECTION 2

THEORY OF OPERATION

2-1. General 3

2-2. Antenna Input 3

2-3. Preamplifier First RF Amplifier 3

2-4. RF Test Point 5

2-5. RF Plate Load 5

2-6. Preamplifier Second RF Amplifier 5

2-7. Preamplifier Second RF Amplifier Plate Circuit 5

2-8. Preamplifier Power Supply 5

2-9. Preamplifier Blower Motor and Fans 6

2-10. Multicoupler First RF Amplifier 6

2-11. Multicoupler First RF Plate Load 6

2-12. Multicoupler Second RF Amplifier 6

2-13. Multicoupler Second RF Amplifier Plate Load 7

2-14. Multicoupler Resistive Outputs to Receivers 7

2-15. Multicoupler Power Supply 7

2-16. Main Chassis 7

SECTION 3

INSTALLATION AND OPERATION

3-1. Introduction 9

3-2. Siting 9

3-3. Unpacking 9

Paragraph | Page

3-4. Electrical Connections 10
3-5. Operation 10

SECTION 4

MAINTENANCE

4-1. Introduction 11
4-2. Preamplifier Alignment Procedure 11
4-3. Test Equipment Required for Preamplifier Alignment 13
4-4. Preamplifier Input and Interstage Alignment 13
4-5. Preamplifier Output Alignment 15
4-6. Preamplifier Overall Alignment 15
4-7. Test Equipment Required for Multicoupler Alignment 16
4-8. Multicoupler Output Stage Alignment 16
4-9. Multicoupler Overall Alignment 17
4-10. Multicoupler Input Standing Wave Ratio 17

SECTION 5

Parts List 25

LIST OF ILLUSTRATIONS

Figure | Title | Page

1-1. Model PM-406 Preamplifier-Multicoupler viii
2-1. Block Diagram, Model PM-406 Preamplifier and Multicoupler 4
4-1. Output Detector (For Preamplifier Alignment) 12
4-2. Plate Detector (For Preamplifier Alignment) 12
4-3. Preamplifier Input and Interstage Response 14
4-4. Overall Response of Preamplifier 14
4-5. Output Detector (For Multicoupler Alignment) 16
4-6. Top View, Preamplifier-Multicoupler, Model PM-406 19
4-7. Rear View, Preamplifier-Multicoupler, Model PM-406 20
4-8. Bottom View, Preamplifier-Multicoupler, Model PM-406 21

Figure	Title	Page
4-9.	Bottom View, RF Preamplifier Chassis, Model PM-406	22
4-10.	Bottom View, RF Multicoupler Chassis, Model PM-406	23
5-1.	Schematic Diagram, Model PM-406, Preamplifier-Multicoupler	35

LIST OF CHARTS AND TABLES

Table	Title	Page
1-1.	Performance Specifications	2
1-2.	Semi-Conductor and Tube Complement	2
4-1.	Normal Operating Tube Socket Voltages	18
Parts List		26-33

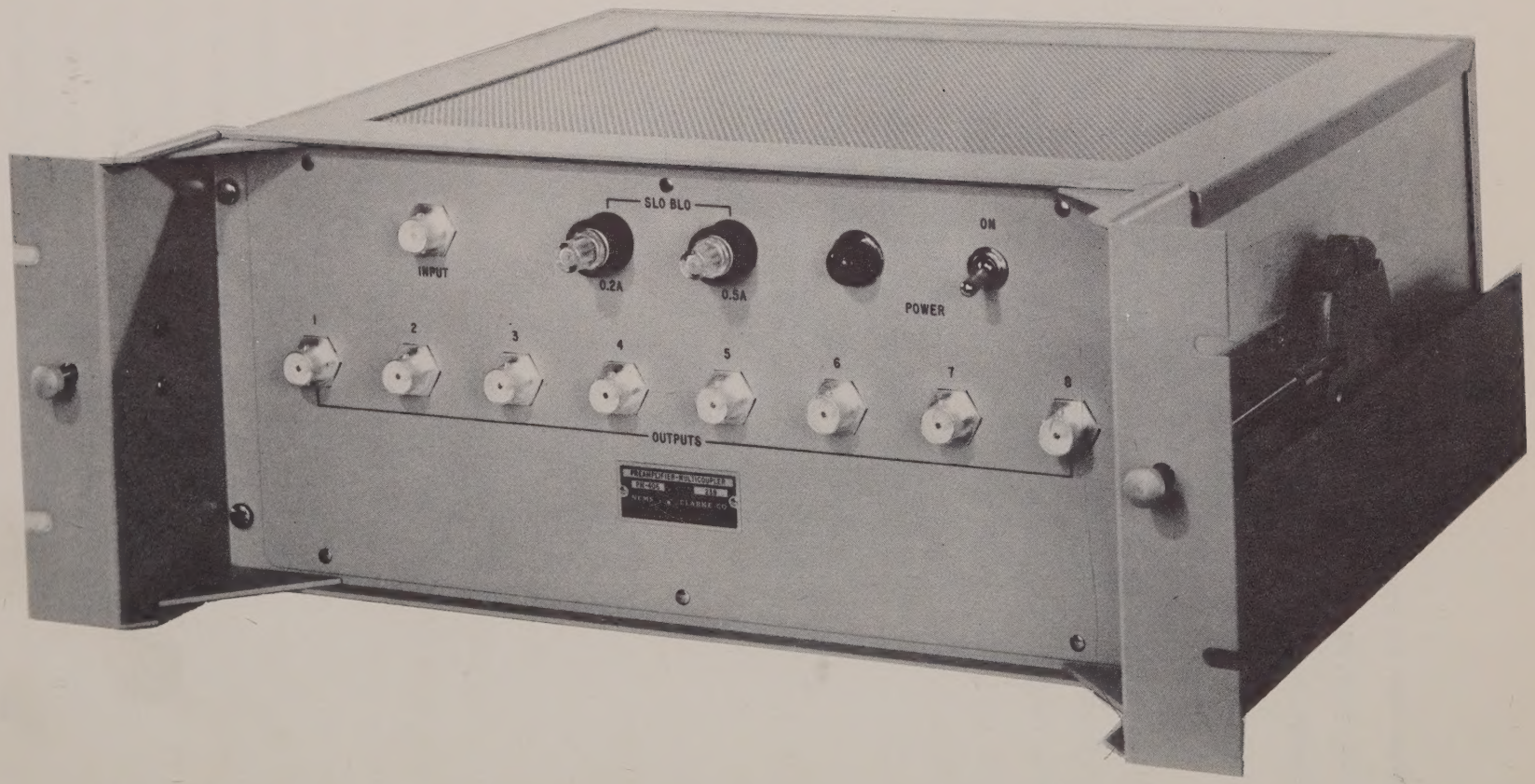


Figure 1-1. Model PM-406 Preamplifier-Multicoupler.

SECTION 1

GENERAL DESCRIPTION

1-1. PURPOSE OF THE EQUIPMENT.

The NEMS-CLARKE CO. Model PM-406 rack mounted Preamplifier-Multicoupler is specifically designed for use as a preamplifier-multicoupler in a telemetry receiving system having a locally sited antenna, thus allowing a short coaxial cable between the antenna and the input of the PM-406. In the event a locally situated antenna is not available, and a greater length of interconnecting cable is necessary between the antenna and the input to the PM-406, a pole-mounted preamplifier such as the PR-203 should be used at the antenna installation; the PM-406 located at the receiver installation may then be considered as a distribution amplifier. Thus in most cases, the PM-406 Preamplifier-Multicoupler provides a reduction in system noise figure over that of the receiver alone, and has the additional advantage of providing eight outputs, for various types of receiving equipment in the telemetry band, from one antenna installation. Since the PM-406 is intended for mounting in a standard nineteen-inch equipment rack, it may be mounted in the rack adjacent to the receivers or operating position and provides a convenient means of connecting the antenna outputs to the various receiving equipments.

1-2. DESCRIPTION OF THE EQUIPMENT.

The Model PM-406 Preamplifier-Multicoupler is intended for rack mounting in a standard 19 inch relay rack and its dimensions are 19" wide, by 7" high, by 16-1/2" deep. Type "C" connectors are used on the front panel of the equipment to facilitate patch-board type operation. The equipment features "bathtub" chassis construction, thus permitting the patch cables to hang from the front of the equipment without protruding. Modifications to this design are available on special order, as are various types of connectors. This equipment permits the use of up to eight receivers with the same antenna system, connections to the input and the various outputs being made on the front panel of the unit. To minimize the effects of overloading the various receivers connected to this unit, the over-all gain is no greater than that required for minimum system noise figure. Thus, the noise figure of the system is no greater than that of the Preamplifier-Multicoupler. The preamplifier section and the multicoupler section each has its own individually fused power supply controlled from a single front panel switch. As all NEMS-CLARKE CO. receivers suitable for telemetry reception have high-beat local oscillators, the isolation between outputs is increased at the high end of the band. A typical figure for isolation between

outputs for the PM-406 at 250 mc is 50 db. The preamplifier and the multicoupler sections of the PM-406 are constructed on separate sub-chassis, thus assuring maximum mechanical rigidity and electrical stability. The equipment has uniform response within 3 db and features a pass band of 215 to 260 mc. Figure 1-1 shows the Model PM-406 Preamplifier-Multicoupler, Table 1-1 shows the performance characteristics, and Table 1-2 shows the Semi-Conductor and Tube Complement.

TABLE 1-1

PERFORMANCE SPECIFICATIONS

Pass Band	215 to 260 megacycles
Uniformity of Response	Within 3.0 db.
Gain	22 db.
Impedance	Designed to operate in a 50 ohm system.
Inputs	1 (one)
Outputs	8 (eight)
Noise Figure	Less than 4.5 db.
Isolation Between Outputs	37 db minimum.
RF Connectors	Type "C" (other types available on request)
Size	19" wide, by 7" high, by 16-1/2" deep.
Power Requirements	115 VAC, 50-60 cps, single phase.

TABLE 1-2

SEMI-CONDUCTOR AND TUBE COMPLEMENT

PREAMPLIFIER

Symbol	Type	Function
V-101	6280/416B	First RF Amplifier
V-102	7077	Second RF Amplifier
V-103	5651	Voltage Regulator
CR-101 thru CR-104	1N539	Bridge Rectifier

MULTICOUPLER

Symbol	Type	Function
V-101	5842/417A	First RF Amplifier
V-102	5842/417A	Second RF Amplifier
CR-101 thru CR-104	1N539	Bridge Rectifier

SECTION 2

THEORY OF OPERATION

2-1. GENERAL.

The NEMS-CLARKE CO. Model PM-406 Preamplifier-Multicoupler is essentially a four stage broadband RF amplifier that has its output divided by a resistive coupling network in such a manner that it provides RF output for up to eight different receivers from a single source of RF energy or antenna. The unit is divided into two sections, each with its own power supply and fuse, operating from a single power source and switch. The preamplifier section has two stages of RF amplification and a blower motor to cool the first RF stage; in addition, the multicoupler section has two stages of RF amplification, and eight resistive networks which serve to isolate each receiver from the others and from the output stage. The unit provides a uniform response over the entire telemetry band from 215 to 260 megacycles. The preamplifier section of the MC-406 contributes approximately 22 db gain in the passband, with a uniformity of response of 2.0 db. The noise figure of the preamplifier and thus of the entire unit, is 4.5 db. The gain of the multicoupler section from the input to any one of the output connectors is approximately unity, and the Multicoupler has a uniformity of response of 1.0 db. The minimum isolation between receiver outputs is 37 db. For additional information concerning the technical aspects of the performance specifications, refer to Table 1-1. The Block Diagram is to be found in Figure 2-1.

2-2. ANTENNA INPUT.

The signal input circuit of the MC-406 Preamplifier-Multicoupler is designed to operate from a 50 ohm antenna or transmission line over the frequency range of 215 to 260 megacycles. The signal may be applied through the "INPUT" connector, a type "C" mounted on the front panel of the unit.

2-3. PREAMPLIFIER FIRST RF AMPLIFIER.

The RF input signal is applied to the cathode of the 6280/416B first RF amplifier, V-101, across the capacitive coupling network consisting of C-101, and C-102 in parallel, and through the inductor, L-101. No blocking capacitor external to the 6280/416B Planar Triode, V-101, is provided, since the RF cathode of this tube performs this function. To prevent loss of signal due to cathode-to-filament capacity, the filaments of V-101 are maintained above RF ground potential with broad band chokes L-103 and L-104. Cathode resistor method of obtaining self bias is used in this amplifier, resistors R-101 and R-102 developing a bias voltage proportional to the current through themselves, and capacitor C-103

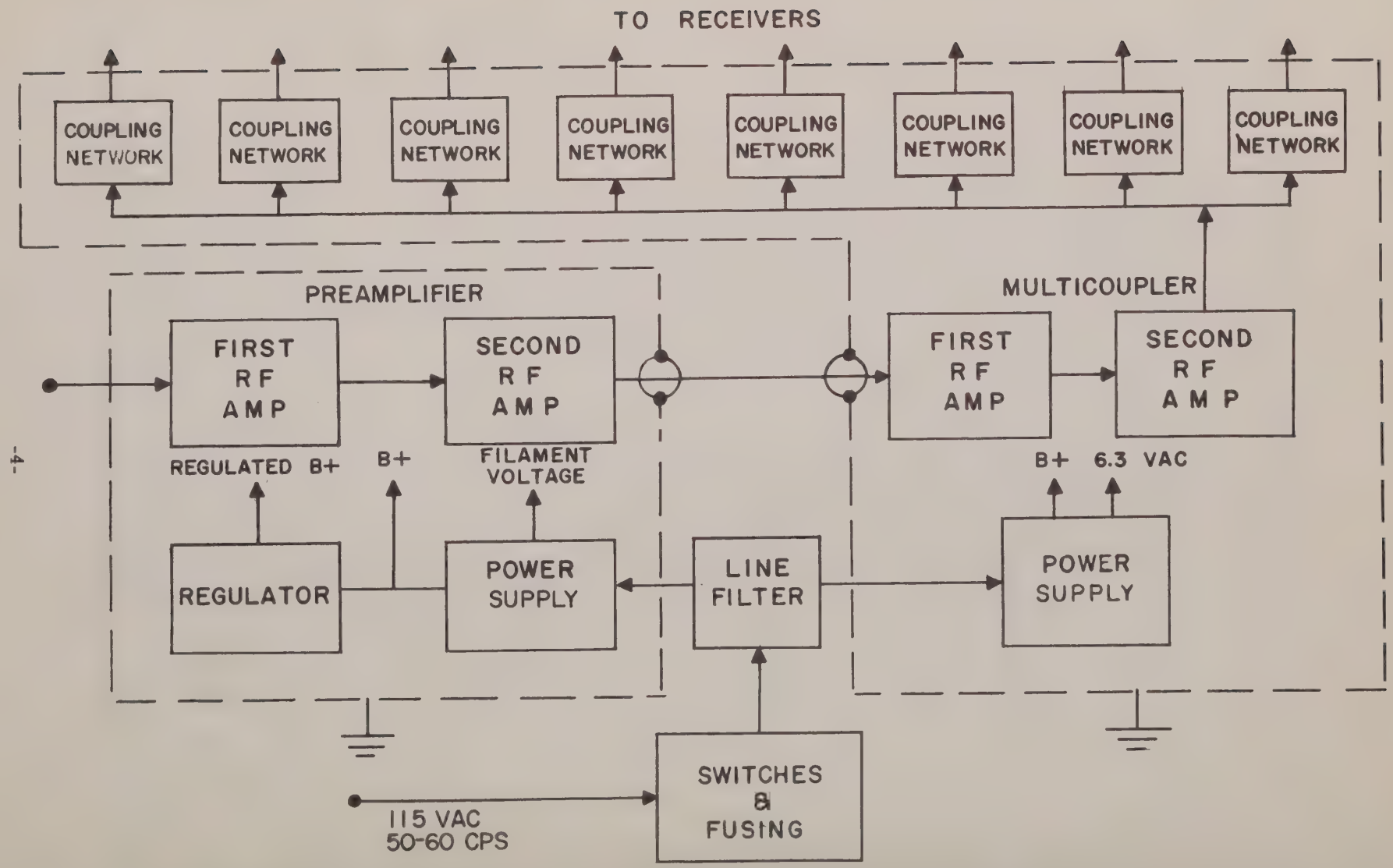


Figure 2-1. Block Diagram, Model PM-406 Preamplifier-Multicoupler.

providing cathode resistor bypassing. The effect of the bias voltage developed by the cathode resistors is largely cancelled by a positive voltage applied to the grid from the divider network consisting of R-108 and R-107, which is across the 5651 B+ voltage regulator tube, V-103. Thus, the effective operating bias is reduced to an appropriate value, the DC degeneration due to the large cathode resistor has considerable stabilizing effect on the 416B tube operation, and performance variations from one tube to the next are minimized if replacement becomes necessary.

2-4. PREAMPLIFIER RF TEST POINT.

A decoupled test point is provided at the junction of the cathode resistors of the first RF amplifier for the purpose of obtaining a relative indication of the cathode current of V-101. A high impedance VTVM at this test point will read the voltage drop across 100 ohms due to this current; thus, a 1.0 volt DC reading at the test point indicates a cathode current of 10.0 milliamperes, etc.

2-5. PREAMPLIFIER RF PLATE LOAD.

The plate of the first RF Amplifier drives a modified "T" network consisting of L-105, L-106, and L-107. This network in turn drives the cathode of the second RF amplifier. This network serves the double purpose of coupling and of matching the high-impedance of the first RF amplifier plate to the relatively low-impedance of the cathode of the second RF Amplifier, V-102.

2-6. PREAMPLIFIER SECOND RF AMPLIFIER.

The output of the modified "T" inductive network, consisting of L-105, L-106, and L-107, drives the cathode of the type 7077 Planar Triode Second RF amplifier through the blocking capacitor, C-108. C-108 also serves to provide part of the series reactance necessary to tune L-107. Cathode resistor method of obtaining self-bias is used in the second RF amplifier, V-102, resistor R-104 developing the bias, and capacitor C-109 providing cathode resistor by-passing.

2-7. PREAMPLIFIER SECOND RF AMPLIFIER PLATE CIRCUIT.

The plate load of the second RF amplifier consists of L-110, L-111, and L-112. L-110 and L-112 are the series elements that feed the output. Capacitor C-113 serves the double purpose of preventing the application of B+ to the output circuit and aiding in the tuning of L-112.

2-8. PREAMPLIFIER POWER SUPPLY.

The preamplifier power supply receives its AC power from the switching circuits of the PM-406

main chassis through the terminal board, TB-101. The power transformer, T-101, delivers high voltage AC to the input of the full wave bridge rectifier from the high voltage secondary winding. The bridge rectifier utilizes four long-life silicon junction diodes to produce pulsating DC which is filtered by a conventional capacitor input LC filter. The voltage regulator tube, V-103, a type 5651, in conjunction with the current limiting resistor, R-106, supplies low voltage B+ to the voltage divider network consisting of R-108 and R-107, which in turn supplies a small positive voltage to the grid of the 416B tube.

2-9. PREAMPLIFIER BLOWER MOTOR AND FANS.

A blower motor, B-101, a Rotron model TA-1, is mounted on the chassis of the preamplifier for the purpose of cooling the 6280/416B tube and circulating air within the confines of the main chassis. A centrifugal type blower supplies forced air to the 6280/416B. A propeller-type four-bladed fan, to circulate air inside the main chassis, is attached to the other end of the motor shaft.

2-10. MULTICOUPLER FIRST RF AMPLIFIER.

The signal from the preamplifier is applied to the input connector, J-103, located on the chassis of the multicoupler. It is then applied across the variable capacitor, C-101, and through the LC combination of L-101 and C-102 to the cathode of the first RF amplifier, V-101, a type 5842/417A vacuum tube. L-101 consists of a 7/16 inch lead of C-102. Cathode resistor method of obtaining self-bias is used in this amplifier, resistor R-101 developing a bias, proportional to the current through itself, of approximately 10.6 volts DC. Cathode resistor bypassing is provided by capacitor C-103. A negative voltage of approximately 10 volts DC is applied to the negative end of R-101, thus nullifying a portion of the voltage, and reducing the effective bias voltage to approximately 0.6 volts DC.

2-11. MULTICOUPLER FIRST RF PLATE LOAD.

The plate load for the first RF amplifier consists of the series resonant inductor, L-103, coupling inductor L-104, and a series tuned circuit consisting of L-105 and C-107. This plate load forms a modified "T" network which serves to match the relatively high-impedance of the first RF amplifier plate circuit to the low input impedance of the cathode circuit of the following stage. This network also acts as a bandpass filter to provide the proper interstage response. Capacitors C-105 and C-106 act as plate decoupling capacitors.

2-12. MULTICOUPLER SECOND RF AMPLIFIER.

The signal from the modified "T" interstage network is applied to the cathode of the second RF

amplifier across inductor L-106. Cathode resistor method of obtaining self-bias is used in this amplifier, resistor R-103 developing the bias, and capacitor C-108 providing cathode resistor bypassing. Resistor R-103 develops approximately 10.6 volts DC across itself, 10 volts DC of which is nullified by the application of 10 volts minus from the power supply, leaving an effective bias of approximately 0.6 volts DC.

2-13. MULTICOUPLER SECOND RF AMPLIFIER PLATE LOAD.

The second RF amplifier plate load consists of series-tuned inductor L-107, coupling inductor L-108, and two parallel capacitors, C-115 and C-111, that serve a double purpose, namely tuning L-107, and preventing the application of B+ to the resistive output coupling networks that feed the various receivers. This network also acts as a bandpass filter to give the overall response the proper shape and to assure sufficient bandwidth to cover the entire telemetry spectrum from 215 to 260 megacycles.

2-14. MULTICOUPLER RESISTIVE OUTPUTS TO RECEIVERS.

Eight resistive terminations are used to match the output of the second RF amplifier to the coaxial transmission line that feeds the input of the receivers used with the Model PM-406 RF Preamplifier-Multicoupler. Each consists of four resistors in a modified pi network, which assures a minimum of 35 db isolation between receiver outputs, and at the same time maintains a constant 50 ohm output impedance. Variations in load on the plate circuit of the second RF amplifier are thereby minimized, and a constant output is guaranteed.

2-15. MULTICOUPLER POWER SUPPLY.

The Multicoupler power supply receives its AC power from the switching circuits of the PM-406 main chassis through the terminal board, TB-101, located on the multicoupler chassis. 115 VAC, 50 to 60 cycles, single phase, is applied to the primary of the power transformer, T-101. The secondary of this transformer applies high-voltage AC to the bridge rectifier, consisting of CR-101 through CR-104. The resulting pulsating DC is filtered by a conventional capacitive-input LC filter. The power supply voltage divider network, consisting of R-137 and R-138, supplies approximately 105 volts positive, and minus 10 volts DC.

2-16. MAIN CHASSIS.

The main chassis of the PM-406 is essentially a mounting surface for the two subsidiary units (the preamplifier and the Multicoupler) and has no operating components that do not aid in connecting the

subsidiary units to equipment external to the unit. Thus, the main chassis has a power input connector, J-201, an AC line filter consisting of capacitors C-201 through C-204, and inductors L-201 and L-202, and the necessary switching and fusing facilities to protect the subsidiary units. A pilot lamp is included to indicate the application of power, and various connectors are provided to allow the application of signal to the input, and the connection of receivers to the various outputs.

SECTION 3

INSTALLATION AND OPERATION

3-1. INTRODUCTION.

The shipping container for the Model PM-406 Preamplifier-Multicoupler consists of an outer and inner corrugated container, with necessary padding to prevent damage to the unit in shipping.

When unpacking the unit, great care should be taken that crowbars or other hard, sharp instruments do not come into contact with the equipment, as such contact may damage finished surfaces or external components. After unpacking, the unit should be thoroughly checked for any broken or loose parts. As received, the unit is completely assembled with chassis housing and dust covers, and all internal connections are complete.

3-2. SITING.

Since the Model PM-406 Preamplifier-Multicoupler is intended for use in conjunction with several receivers, it usually will be convenient to mount it near, or in, the equipment rack containing the receivers with which it is to be associated. The unit may be installed in a blank space in the rack reserved for this purpose, by simply mounting it with appropriate screws through the holes provided in the rack and in the PM-406. Power connections may then be made to the rear of the equipment, while all signal connections are made to the front of the unit in "patchboard" style.

3-3. UNPACKING.

The RF Preamplifier-Multicoupler Model PM-406 weighs 24 pounds before packing for shipment, and approximately 26 pounds when packed. The dimensions of the inner container are 20 by 8 by 18 inches as packed for commercial shipment. The unit should be unpacked as follows:

(a) Carefully open the outer container and remove the inner container.

(b) Open the inner container and lift out the PM-406; remove all pads as necessary to accomplish this operation.

(c) Remove and set aside all packing material, carefully checking to see that no components of the equipment are missing.

(d) Check the PM-406 for possible damage during shipment. Make a visual inspection of the circuit wiring to insure that all electrical connections are intact. All tubes should be checked to see that they make good contact in their sockets.

3-4. ELECTRICAL CONNECTIONS.

All internal electrical connections of the Model PM-406 RF Preamplifier-Multicoupler are complete. There are ten external connectors on the unit: The power input connector, J-201, is located on the rear apron of the chassis, and access is provided through the rear of the rack housing. From the power input connector, connections are made to the main power source of the installation. A signal input connector (from coaxial transmission line or antenna) is provided on the recessed front panel of the unit. Eight output connectors (to telemetry receivers) are also provided on the recessed front panel of the unit. All connectors are labeled with their appropriate functions by adjacent stencilled or engraved titles. When all connections have been properly made, the Model PM-406 Preamplifier-Multicoupler is ready for operation.

3-5. OPERATION.

Place the power switch, S-201, in the "ON" position. This applies 115 VAC, 50 to 60 cps, single phase, alternating current to the inputs of the preamplifier and the multicoupler subsections. The unit will be ready approximately thirty seconds after the application of power. Observe the associated receivers for signs of operation such as signal level indications, tuning meter movement, and/or output from the various receiver speakers.

SECTION 4

MAINTENANCE

4-1. INTRODUCTION.

Maintenance of the Model PM-406 Preamplifier-Multicoupler is necessarily limited to checking pilot lamps, switches, tubes, and fuses since the unit is relatively uncomplicated, containing few moving parts and comparatively simple circuitry. If it is certain that a defect has arisen in the circuitry of the unit itself, and cannot be effectively remedied while the equipment is in the rack, it should be removed and taken to a convenient location for trouble shooting and alignment.

When a vacuum tube must be replaced in the PM-406, the critical nature of the alignment necessitates that the alignment of the circuit associated with the tube be checked to assure optimum operation of the various amplifiers. Alignment checks should follow the procedures shown in paragraph 4-2 and following. The high frequency tubes used in this equipment are of recent design and consequently only the most modern tube checkers will have provisions for testing them. In the event that such a tube checker is available to maintenance personnel, the tubes should be removed, cleaned, inspected, and tested one at a time, the first tube being reinstalled before proceeding to the next. Tubes should not be replaced unless equipment is available for realignment. To remove a miniature tube, first remove the shield, and then using a suitable tube puller, pull the tube straight out of the socket. To remove a type 7077 tube such as V-102, grasp the tube at the center flange with a small pair of needle-nose pliers, the jaws of which have been lined with a soft material to prevent damage to the tube, and pull directly up. Care should be exercised not to impart a twisting motion that might break the tube. To remove a type 6280/416B tube such as that used for the first RF amplifier for the preamplifier, first remove the screws holding the mounting bracket. Gently slide the socket off the tube pins. Using a pair of pliers to hold the plate cap so as to prevent bending the inductor, L-105, carefully unscrew the tube from the plate cap. Care should be exercised not to bend or change the shape of the inductor, L-105, or considerable realignment will be required to restore normal operation.

4-2. PREAMPLIFIER ALIGNMENT PROCEDURE.

The preamplifier section of the Model PM-406 will normally maintain good alignment for long periods of time and will require little or no realignment. If, however, a tube or component is replaced and it becomes obvious that the equipment will require realignment, refer to the following procedure

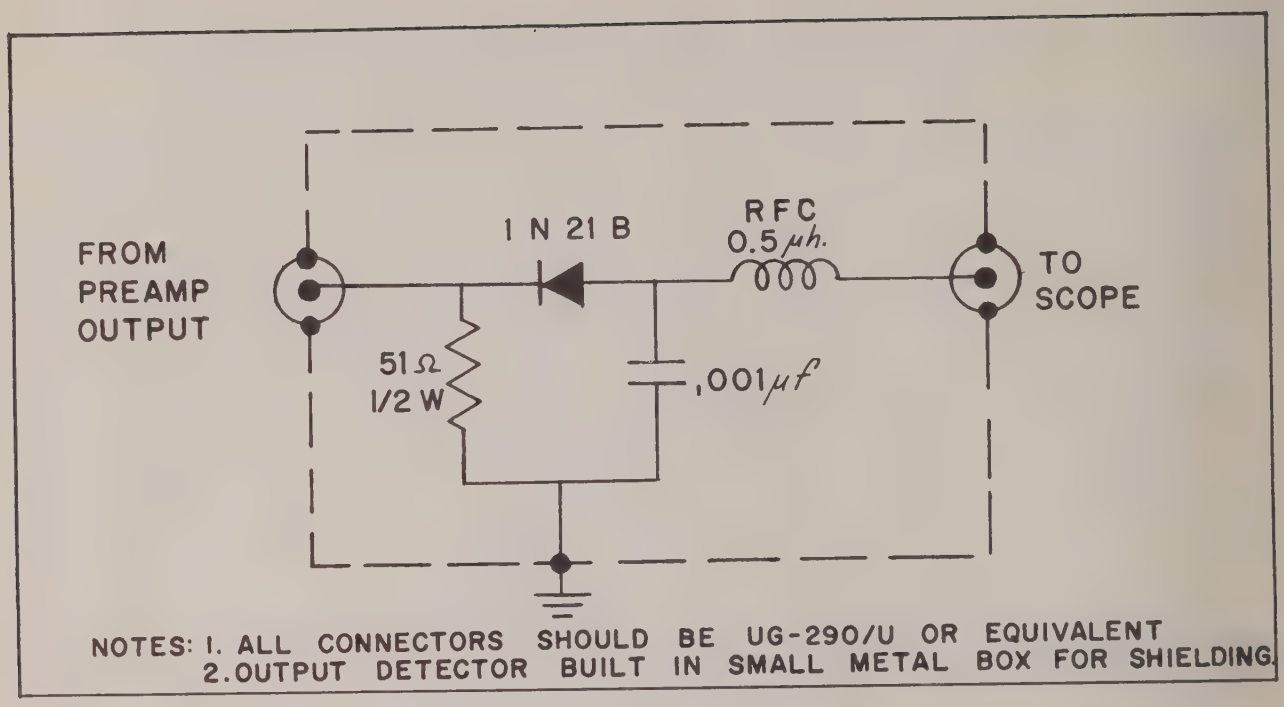


FIG. 4-1. OUTPUT DETECTOR (FOR PREAMPLIFIER ALIGNMENT)

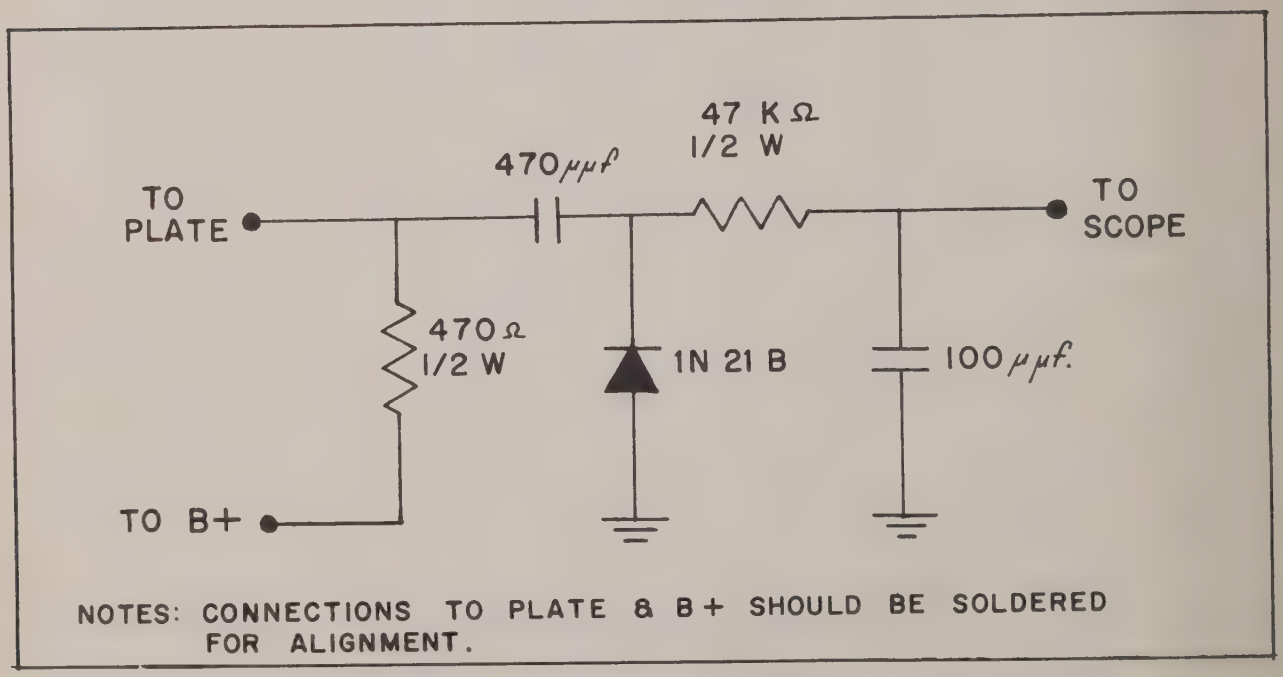


FIG. 4-2. PLATE DETECTOR (FOR PREAMPLIFIER ALIGNMENT)

NOTE: ALL CONNECTORS TO UG-290/U OR EQUIVALENT.

for instructions. In order to minimize the frequency response required of the detectors (including their decoupling networks) used for visual alignment, the sweep generator sweep width used should be no greater than that required to produce the desired oscilloscope pattern. The marker generator signal should be coupled in as required to produce a suitable marker pip. Check to see that the marker generator connection does not upset the response shape by disconnecting the marker generator and observing that the response shape does not change. In general, the marker signal can be introduced by connection to a turn or two of insulated wire wrapped around the sweep generator lead near the point of connection to the circuit under test, or by coupling to the sweep generator lead through a small capacitor. In order to avoid extraneous coupling or regeneration, the sweep and the marker generator leads should be dressed out and away (toward the input end) from the stages already tuned.

4-3. TEST EQUIPMENT REQUIRED FOR PREAMPLIFIER ALIGNMENT.

The following equipment is recommended for use in following the alignment procedures for the Preamplifier section of the PM-406:

(a) Transitron Model SG-132 Sweep Generator or equivalent.

(b) Noise Generator, either of the following two types:

(1) New London Instrument Corp. Model 403.

(2) Polytechnic Research and Development Company, Inc. Model 904, VHF-UHF.

(c) Output Detector, see Figure 4-1.

(d) Plate Detector, see Figure 4-2.

(e) Assorted 50 ohm cables and connectors.

(f) Micro-Lab Model AB-6 6 db attenuator, 2 ea.

4-4. PREAMPLIFIER INPUT AND INTERSTAGE ALIGNMENT.

(a) Connect 6 db attenuator to preamplifier input jack, J-102.

(b) Connect the sweep generator through a length of RG-55/U cable to the 6 db attenuator.

(c) Disconnect the plate lead of V-102. Connect the plate detector (Figure 4-2) between the plate of V-102 and the B plus end of L-111.

(d) Connect the vertical input of the SG-132 to the plate detector output. Adjust the vertical gain as needed for useable presentation on the scope of the SG-132 of the response curve.

(e) Adjust L-105, L-107 and coupling L-106 until an overcoupled response is obtained with a

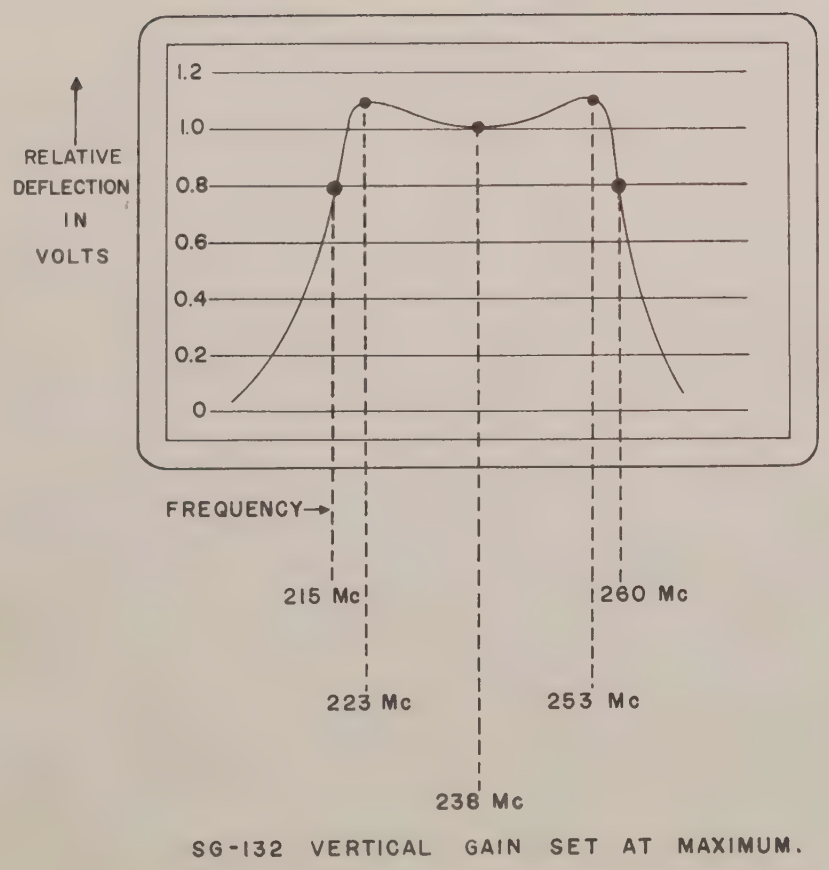


Fig. 4-3. Preamplifier Input and Interstage Response

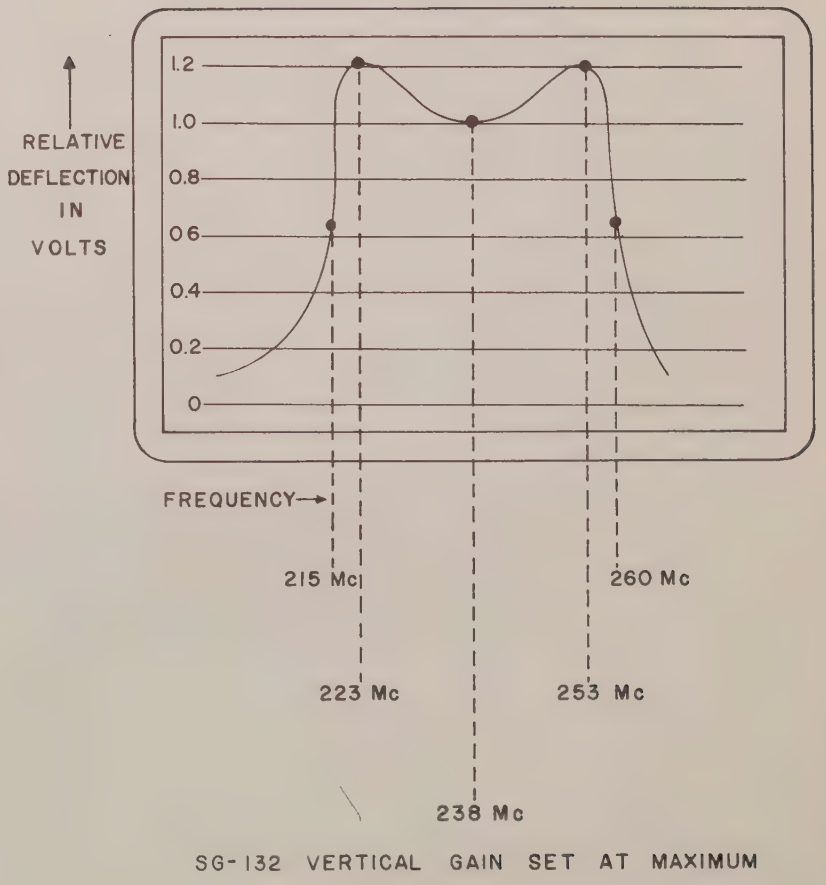


Fig. 4-4. Overall Response of Preamplifier

peak to peak separation of approximately 30 mc, centered at 238 mc. The response at 215 and 260 mc should be down 10% from the value at 238mc, and the peak response at 223 and 253 mc should be 5% above the 238 mc response. *NOTE: The output and plate detectors specified in figures 4-1 and 4-2 have square law response, therefore, the response curve squared will be displayed on the scope of the SG-132 signal generator. See Figures 4-3 and 4-4.

4-5. PREAMPLIFIER OUTPUT ALIGNMENT.

(a) Remove the plate detector and reconnect the plate of V-102.

(b) Plug the output detector (figure 4-1) into the preamplifier output connector, J-105, through a 6.0 db attenuator.

(c) Disconnect the capacitor C-108 from the cathode of V-102. Connect the SG-132 through a short length of RG-55/U cable, a 6.0 db attenuator, and a series 0.001 μf dc blocking capacitor to the cathode of the RF amplifier, V-102. Tune L-107, C-110 and coupling inductor, L-109 for an overcoupled response curve that is centered at 238 mc and drops off 10% at 215 and 260 mc. The maximum peaks at 223 and 253 mc should be approximately 5% above the 238 mc response.

(d) Remove the SG-132 from the cathode of V-102 and reconnect capacitor C-107.

4-6. PREAMPLIFIER OVERALL ALIGNMENT.

(a) For the final adjustment, apply the output of the SG-132 to the input jack, J-102, and trim L-103, L-107, and coupling L-106. The resulting response curve should be centered at 238 mc, the peak response at 223 and 253 mc should be approximately 10% above the level at 238 mc the response at 215 and 260 mc should be down 20% from the 238 mc level. See the response curve as shown in figure 4-4.

(b) Connect the diode noise generator to the input jack, J-102. Connect the Model 1502-A NEMS-CLARKE receiver with post amplifier to the output jack, J-105. Adjust C-101 and L-101 for minimum noise figure at 238 mc and for an approximately equal noise figure at 215 and 269 mc.

(c) The noise figure is measured by adjusting the post amplifier gain (with 3 db attenuator out) for a reference level output on its meter with the noise diode current reduced to zero. The 3 db attenuator is then switched in the post amplifier and the noise diode current is increased until the same reference level is obtained. The noise figure is then equal to $201R_O$. For example, if the noise diode current is 2.5 mc, then the noise figure is found to be $20 \times 2.5 \times 10^{-3} \times 50$ equals 2.5 or expressed in db, 3.98 db.

(d) Repeat (a) as needed after (b) and (c) are performed.

(e) Remove all test equipment and reassemble the preamplifier. This completes the alignment, of the preamplifier section.

4-7. TEST EQUIPMENT REQUIRED FOR MULTICOUPLER ALIGNMENT.

The following equipment is required for performing the alignment procedures:

(a) Transitron Model SG-132 Sweep Generator, or equivalent.

(b) Output Detector: See figure 4-5.

(c) Assorted 50 ohm cables and connectors.

(d) Micro-Lab AB-6 6.0 db attenuator.

4-8. MULTICOUPLER OUTPUT STAGE ALIGNMENT.

(a) Connect the output detector (see Figure 4-5) to output connector J-107.

(b) Unsolder C-107 from the cathode pin of V-102. (Pin No. 6)

(c) Solder the center conductor of a short length of RG-55/U cable through a .001 μf disc ceramic capacitor to pin No. 6 of V-102.

(d) Adjust the sweep generator for 240 mc center frequency and 20% deviation. Use the maximum output, 110,000 microvolts.

(e) Adjust L-107. C-111, and L-108, for a transitionally coupled response centered at 238 mc. (L-108 is adjusted by a slight bending of the lead connecting L-107 to C-110).

(f) Remove the signal generator cable from V-102 and reconnect C-107. (L-105 consists of the leads of C-107, and it is important to maintain the same length when reconnecting C-107).

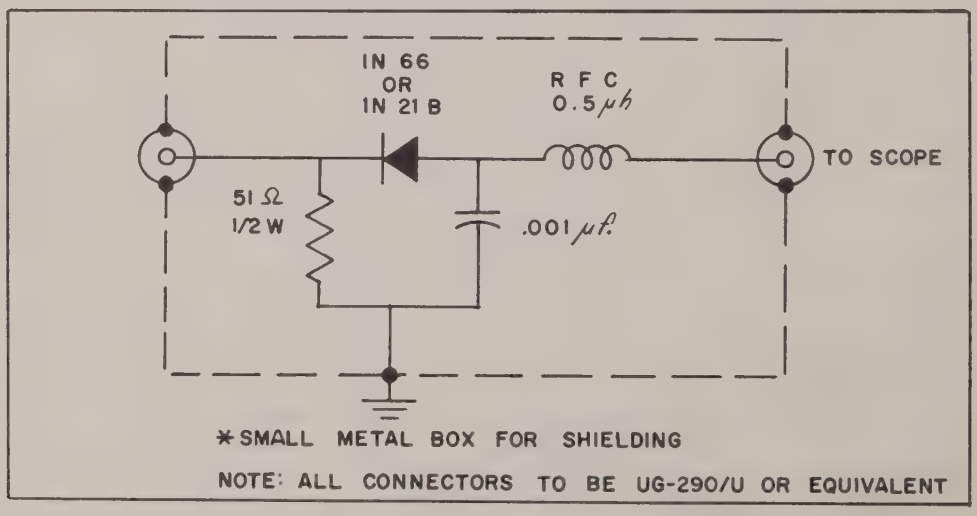


Figure 4-5. Output Detector (For Multicoupler Alignment).

4-9. MULTICOUPLER OVERALL ALIGNMENT.

(a) Connect the SG-132 Sweep Generator to the input jack, J-103.

(b) Adjust L-103, L-104, and C-107 for an overall response curve centered at 238 mc with response down approximately .85 db at 215 and 260 mc. The maximum peak response in the pass band referred to the 238 mc level is plus 0.3 db.

4-10. MULTICOUPLER INPUT STANDING WAVE RATIO.

(a) C-101 should be adjusted for minimum SWR on the input transmission line over the frequency range of 215 to 260 mc. This may be done by connecting the sweep generator (using the same calibration as for step 4-8 (d) to J-103 through a long length of RG-55/U cable. Approximately 25 to 30 feet of cable is required. The output detector is connected by means of a "T" connector to the signal generator output connector. Before connecting the cable to the Multicoupler, adjust the vertical gain of the SG-132 for a peak-to-peak deflection of 2 divisions. The pattern seen will represent maximum SWR on the open ended cable.

(b) After connecting the cable to the input of the Multicoupler, adjust capacitor C-101 for a minimum SWR pattern. The maximum peak-to-peak deflection should be about 0.2 divisions, corresponding to an SWR of 1.2.

(c) If the minimum of the SWR display is not centered at 238 mc adjust inductor L-101, by changing the lead length of C-102 as needed. Recheck the response curve after adjusting C-101.

(d) Remove all test equipment, and reassemble the Multicoupler. This completes the alignment procedure.

TABLE 4-1

NORMAL TUBE SOCKET VOLTAGES

MODEL PM-406 PREAMPLIFIER-MULTICOUPLER

NORMAL TUBE SOCKET VOLTAGES (PREAMPLIFIER)

SYMBOL	ELEMENT	VOLTAGE	SYMBOL	ELEMENT	VOLTAGE	SYMBOL	ELEMENT	VOLTAGE
V-101	Plate	+ 232	V-102	Plate	+ 147	V-103	1 & 5	± 85
	Grid	+ 5.25		Grid	0		7	0
	Cathode	+ 5.80		Cathode	+ .45			
	Heater	6.3V AC		Heater	6.3V AC			

NOTES: B plus voltage at output of power supply (Junction of L-113, and C-116), plus 250 VDC.

NORMAL TUBE SOCKET VOLTAGES (MULTICOUPLER)

Symbol No.	Type	Pin Numbers								
		1	2	3	4	5	6	7	8	9
V-101	5842/ 417A	102	0	0	0	0	.63	0	0	6 VAC RMS
V-102	5842/ 417A	102	0	0	0	0	.57	0	0	6 VAC RMS

NOTES:
1. B plus at power supply approximately 105 volts DC.
2. B minus at power supply approximately 10 volts DC.
3. All Voltages measured with respect to chassis ground with High-Impedance VTVM, such as RCA WV-77A, or equivalent.
4. Power input to unit to be 115 volts AC, 60 cycles, single phase, alternating current.

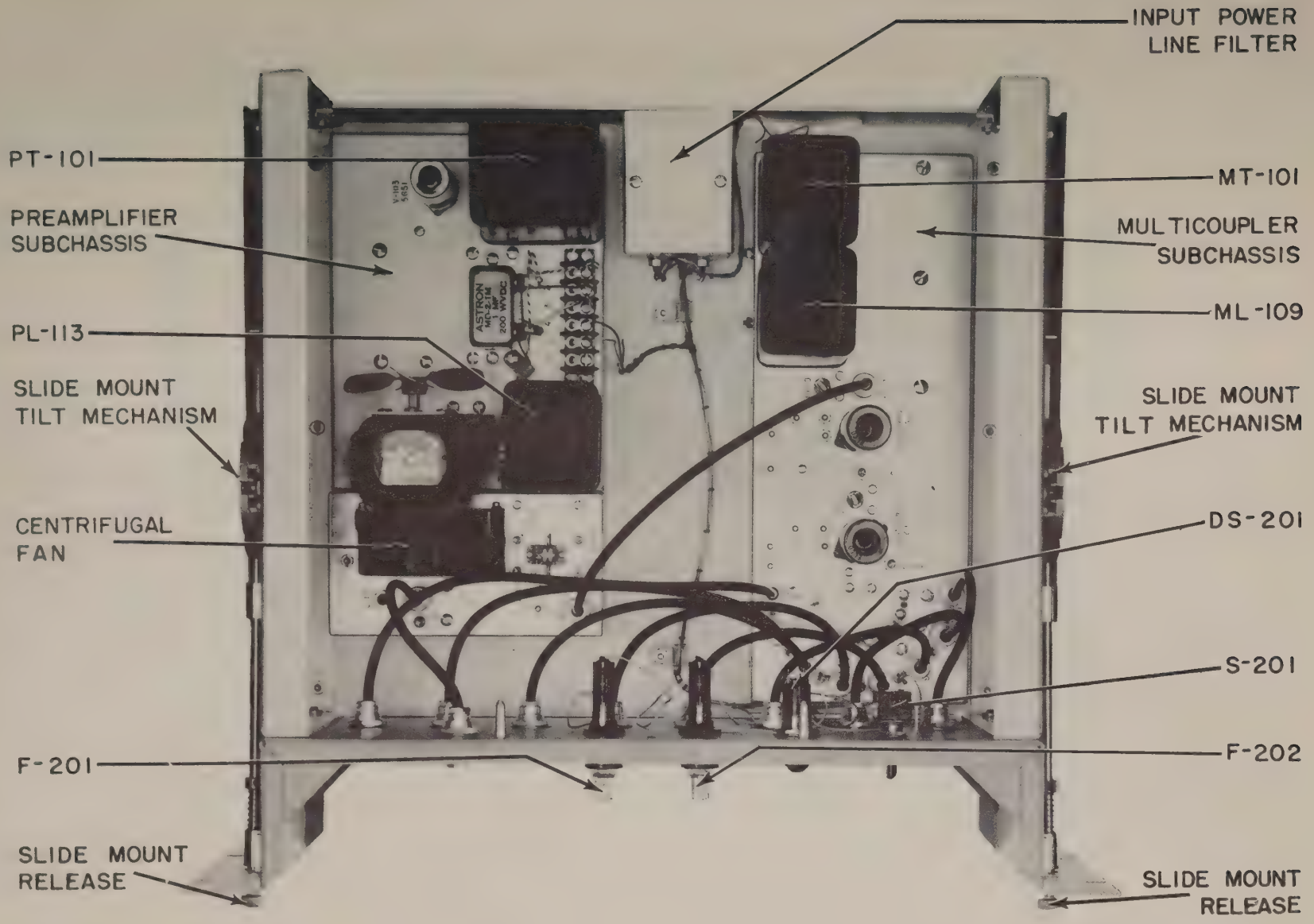


Figure 4-6. Top View, Preamplifier-Multicoupler, Model PM-406.

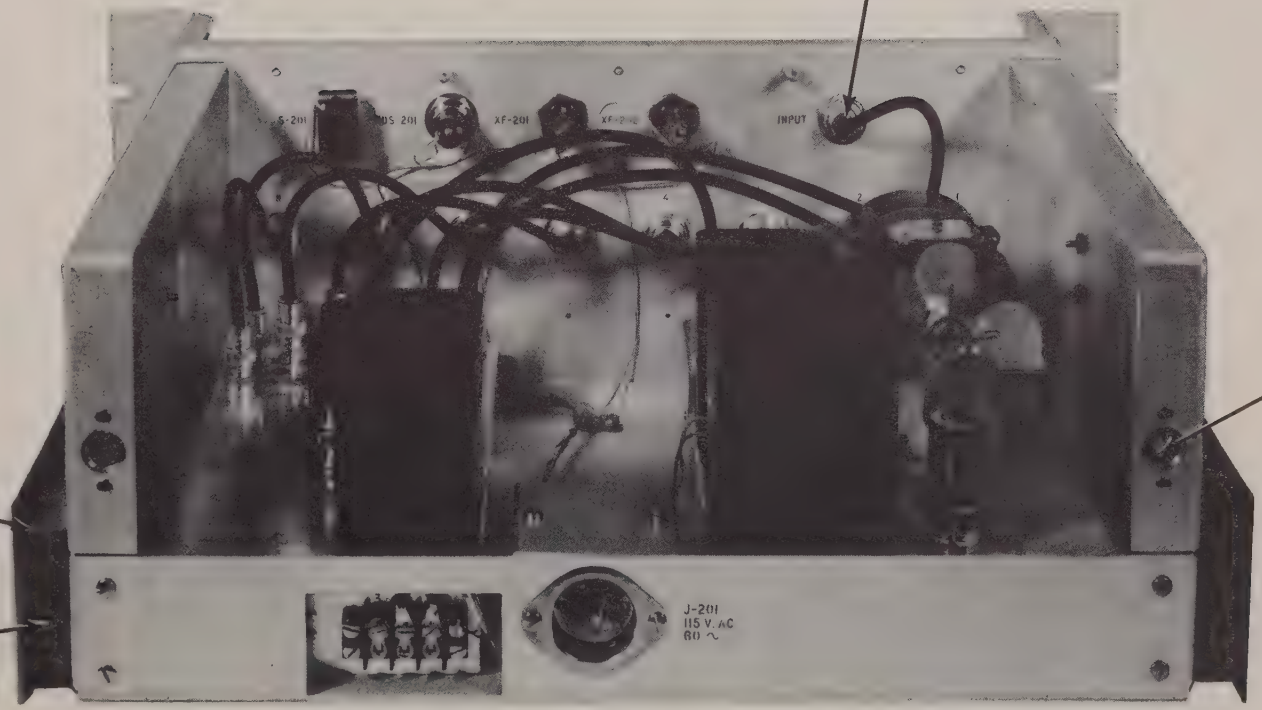


Figure 4-7. Rear View, Preamplifier-Multicoupler, Model PM-406.

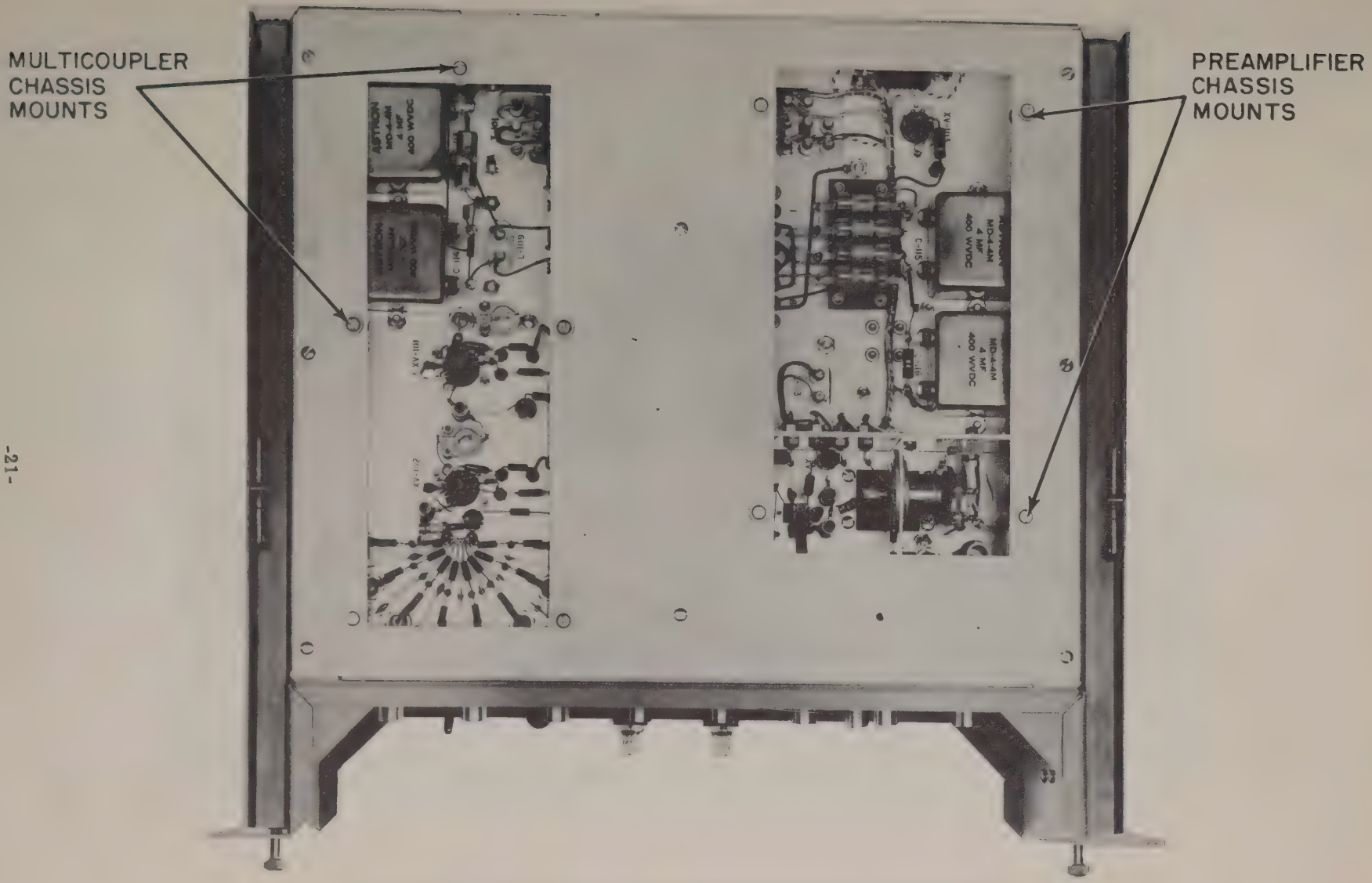


Figure 4-8. Bottom View, Preamplifier-Multicoupler, Model PM-406.

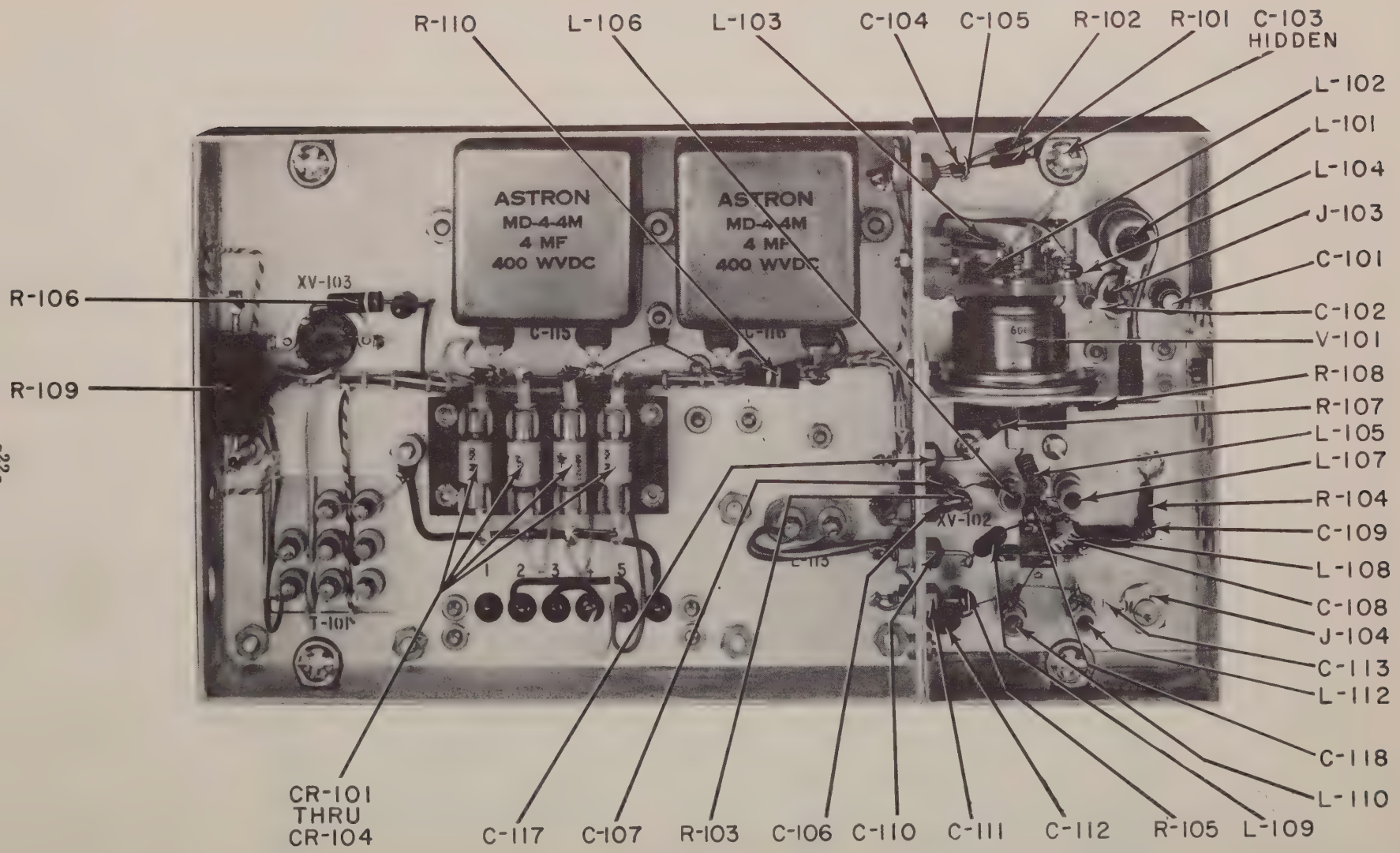


Figure 4-9. Bottom View, RF Preamplifier Chassis, Model PM-406.

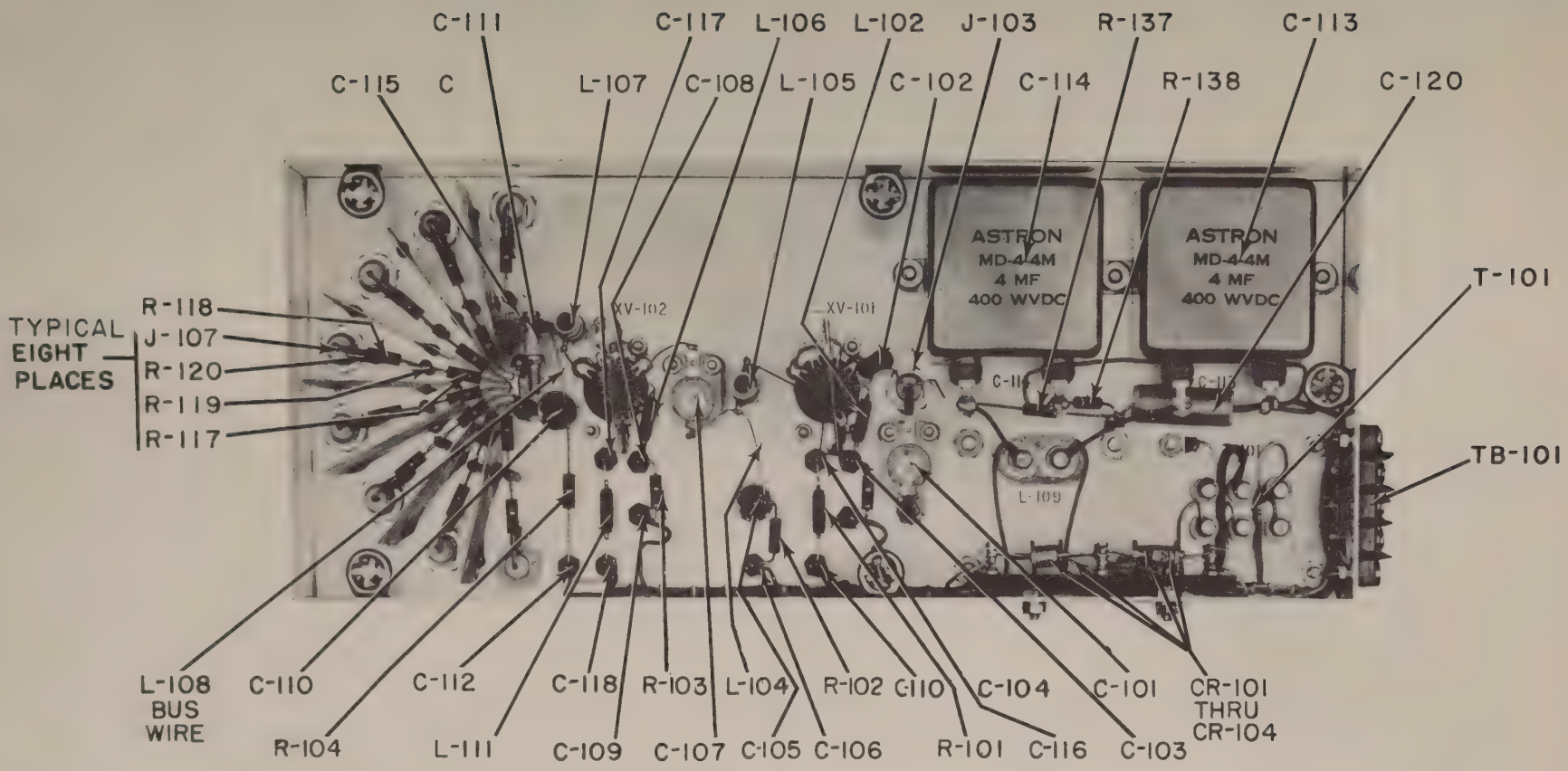


Figure 4-10. Bottom View, RF Multicoupler Chassis, Model PM-406.

SECTION 5

MAINTENANCE PARTS LIST MODEL PM-406

PREAMPLIFIER-MULTICOUPLER

When ordering replacement parts, give the equipment name and model number, and the symbol number and description of each item ordered.

Replacement parts which will be supplied against an order may not be exact duplicates of the original parts. However, only minor differences in the electrical or mechanical characteristics will be involved and, consequently, will in no way impair the operation of the equipment.

Maintenance personnel will note that the parts list is divided into three parts: the Main Chassis Components, the Preamplifier Component and the Multicoupler Components. Each part of the list may readily be identified by the type of symbol numbers used in the first column. Thus, PR-108 signifies resistor R-108 in the Preamplifier subchassis, MC-101 signifies C-101 on the Multicoupler subchassis. Symbol numbers preceded by neither an M or a P correspond to components that are to be found on the main chassis of the equipment.

SECTION 5

MAINTENANCE PARTS LIST MODEL PM-406

PREAMPLIFIER-MULTICOUPLER

Main Chassis Components

Symbol No.	Description	All Symbols Involved
C-201	CAPACITOR, CERAMIC: .005 μf, 1400V, RMC Type U.	C-201, C-202
C-202	Same as C-201.	
C-203	CAPACITOR, CERAMIC: feedthru, .001 μf, GMV, 500WVDC, Sprague 514C1.	C-203, C-204
C-204	Same as C-203.	
DS-201	PILOT LAMP ASSEMBLY: Dialco 53408-991 w/NE-51 Lamp.	DS-201
F-201	FUSE: slo-blo, 0.5 amp, MDL, Bussman.	F-201
F-202	FUSE: slo-blo, 0.2 amp, MDL, Bussman.	F-202
J-201	PLUG: Hubbell No. 7486	J-201
J-202	CONNECTOR: PANEL JACK: Type "C", No. UG-704/U	J-202, J-203, J-204, J-205, J-206, J-207, J-208, J-209, J-210
J-203	Same as J-202.	
J-204	Same as J-202.	
J-205	Same as J-202.	
J-206	Same as J-202.	
J-207	Same as J-202.	
J-208	Same as J-202.	
J-209	Same as J-202.	
J-210	Same as J-202.	
L-201	COIL INDUCTOR: Per Nems-Clarke Dwg. AA-15,060.	L-201, L-202
L-202	Same as L-201.	
P-201	CONNECTOR: Plug body, Hubbell No. 7484	P-101
P-211	CONNECTOR: Plug, electrical integral part of No. 3533 Cornish power cord, w/228 Cornish adaptor.	
S-201	SWITCH, SPST: Smith No. 520.	
XDS-201	SOCKET: PILOT LAMP: Assembly Dialco No. 53408-991 w/NE-51 Lamp.	
XF-201	ILLUMINATING FUSEHOLDER: Bussman Type HKL.	XF-201, XF-202
XF-202	Same as XF-201.	
	PREAMPLIFIER COMPONENTS	
PB-101	MOTOR, BLOWER: Rotron type TA-1, duplex motor series. 433 AS, 115VAC, single phase, 50-60 cycles; one blower housing; CCW rotation; one type 1504 impeller wheel opposite end, CCW rotation; air flow "L".	PB-101

Symbol No.	Description	All Symbols Involved
PC-101	CAPACITOR, VARIABLE: 0.7 to 8.0 μμf, 1500 WVDC, JFD Mfg. Co. VG-3G	PC-101
PC-102	CAPACITOR, CERAMIC: 10.0 μμf ±10%, 500 WVDC, No. CC-20CH100K per JAN-C-20A	PC-102
PC-103	CAPACITOR, STANDOFF: 0.001 μf, MRC, 500 WVDC, Sprague 507C2.	PC-103, PC-109
PC-104	CAPACITOR, CERAMIC: feedthru, 0.001 μf, GMV, 500 WVDC, Sprague 514C1.	PC-104, PC-105, PC-106, PC-110, PC-111, PC-117
PC-105	Same as PC-104.	
PC-106	Same as PC-104.	
PC-107	CAPACITOR, SILVER, MICA, BUTTON: 1000 μμf, ±10%, 300 WVDC, No. CB21PBD102K, per MIL-C-10950.	PC-107, PC-112
PC-108	CAPACITOR, CERAMIC: 6 μμf, ±.5 μμf, 500V, No. CC20CH-6ROD, per JAN-C-20A.	PC-108
PC-109	Same as PC-103.	
PC-110	Same as PC-104.	
PC-111	Same as PC-104.	
PC-112	Same as PC-107.	
PC-113	CAPACITOR, CERAMIC: 4.4 μμf ±.25 μμf, 500V, CC20CH-4R4C per JAN-C-20A.	PC-113
PC-114	CAPACITOR, PAPER: 1.0 μf ±20%, 200 WVDC, Astron MD-2-1M.	PC-114
PC-115	CAPACITOR, PAPER: bathtub, 4 μf ±20%, 400V, Astron MD-4-4M.	PC-115, PC-116
PC-116	Same as PC-115.	
PC-117	Same as PC-104.	
PC-118	CAPACITOR, CERAMIC DISC: .001 μf, GMV, 500V, Sprague 40C230A.	PC-118
PCR-101	RECTIFIER, SILICON: Sarkes-Tarzian No. 1N1084	PCR-101, PCR-102, PCR-103, PCR-104
PCR-102	Same as PCR-101.	
PCR-103	Same as PCR-101.	
PCR-104	Same as PCR-101.	
PE-103	SHIELD, TUBE: for 7 pin miniature socket, No. TS102U02.	PE-103
PJ-103	CONNECTOR, RECEPTACLE, BNC: UG-1094/U	PJ-103, PJ-104
PJ-104	Same as PJ-103.	
PL-101	INDUCTANCE: Coil per Nems-Clarke Co. Dwg. No. AA-19,973.	PL-101

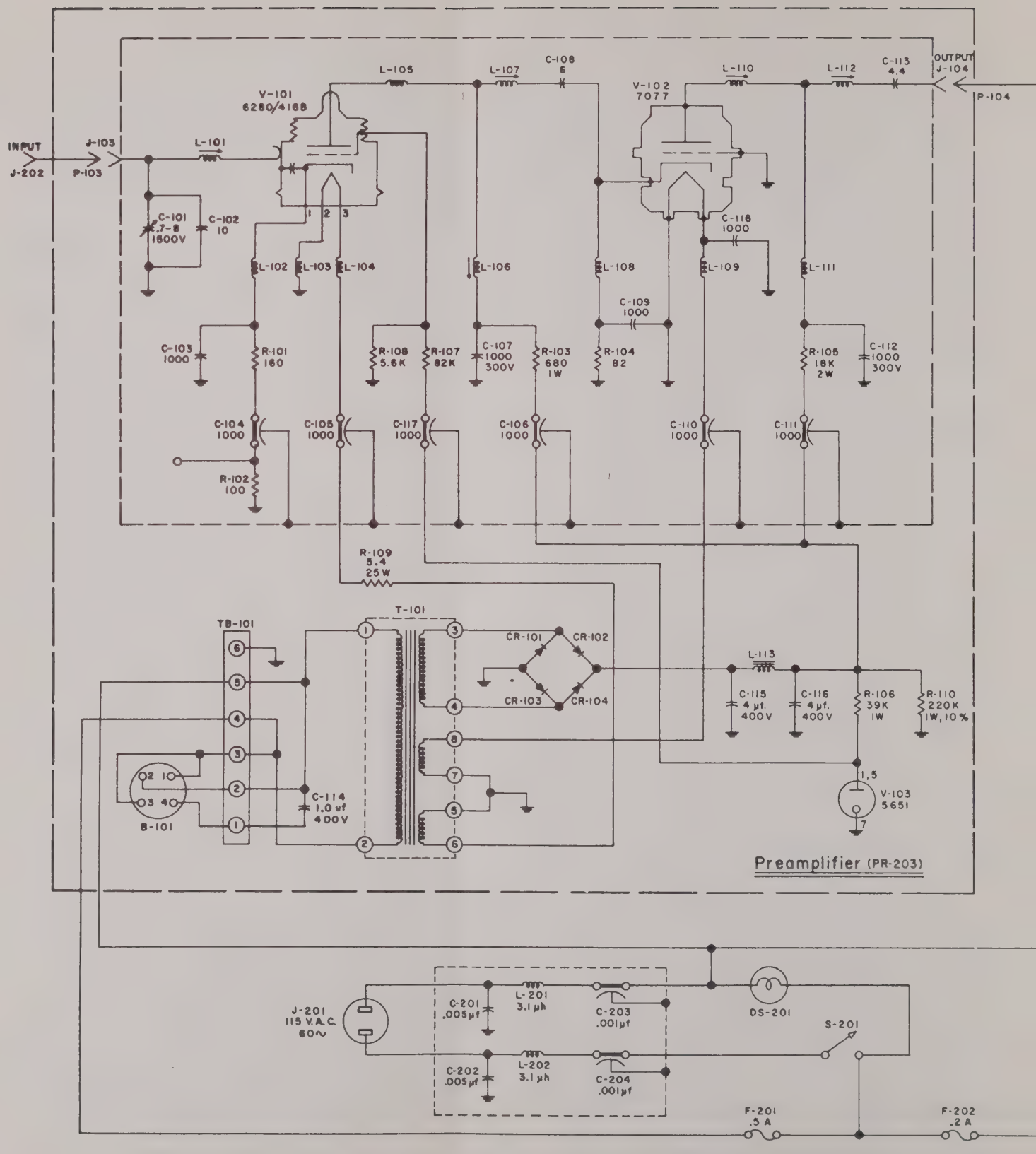
Symbol No.	Description	All Symbols Involved
PL-102	INDUCTANCE: Coil per Nems-Clarke Co. Dwg. No. AA-17,422.	PL-102, PL-103, PL-104
PL-103	Same as PL-102.	
PL-104	Same as PL-102.	
PL-105	INDUCTANCE: Coil per Nems-Clarke Co. Dwg. No. A-19,974.	PL-105
PL-106	INDUCTANCE: Coil per Nems-Clarke Co. Dwg. No. AA-19,975-1.	PL-106
PL-107	INDUCTANCE: Coil per Nems-Clarke Co. Dwg. No. AA-19,975-2.	PL-107
PL-108	INDUCTANCE: Coil per Nems-Clarke Co. Dwg. No. AA-19,976.	PL-108, PL-109
PL-109	Same as PL-108.	
PL-110	INDUCTANCE: Coil per Nems-Clarke Co. Dwg. No. AA-19,975-3.	PL-110
PL-111	INDUCTANCE: Wire, bus wire No. 22, 7/8" No. 24 Phelps Dodge sodereze.	PL-111
PL-112	INDUCTANCE: Coil per Nems-Clarke Co. Dwg. No. AA-19,975-4.	PL-112
PL-113	INDUCTANCE: Choke assembly per Nems-Clarke Co. Dwg. No. AB-17,400.	PL-113
PP-103	CONNECTOR, PLUG: Type BNC, UG-88/U	PP-103, PP-104
PP-104	Same as PP-103.	
PR-101	RESISTOR, FIXED COMPOSITION: 160 ohms ±5%, 1/2W, RC20-GF161J, per MIL-R-11A.	PR-101
PR-102	RESISTOR, FIXED COMPOSITION: 100 ohms ±5%, 1/2W, RC20-GF101J, per MIL-R-11A.	PR-102
PR-103	RESISTOR, FIXED COMPOSITION: 680 ohms ±5%, 1W, RC32-GF681J, per MIL-R-11A.	PR-103
PR-104	RESISTOR, FIXED COMPOSITION: 82 ohms ±5%, 1/2W, RC20-GF820J per MIL-R-11A.	PR-104
PR-105	RESISTOR, FIXED COMPOSITION: 18,000 ohms, ±5%, 2W, RC42-GF183J per MIL-R-11A.	PR-105
PR-106	RESISTOR, FIXED COMPOSITION: 39,000 ohms, ±5%, 1W, RC32-GF393J, per MIL-R-11A.	PR-106
PR-107	RESISTOR, FIXED COMPOSITION: 82,000 ohms ±5%, 1/2W, RC20-GF823J, per MIL-R-11A.	PR-107
PR-108	RESISTOR, FIXED COMPOSITION: 5600 Ω ±5%, 1/2W, RC20-GF562J, per MIL-R-11A.	PR-108
PR-109	RESISTOR, WIREWOUND: 5.4 Ω ±3%, 25W, Dalohm RH25.	PR-109
PR-110	RESISTOR, FIXED COMPOSITION: 220K ±10%, 1W, RC32GF-224K, per MIL-R-11A.	PR-110
PT-101	TRANSFORMER, ASSEMBLY: per Nems-Clarke Co. AB-17,407.	PT-101
PTB-101	TERMINAL STRIP: Cinch Jones No. 6-140-Y	PTB-101
PV-101	TUBE, ELECTRON: Western Electric No. 6280/416B.	PV-101

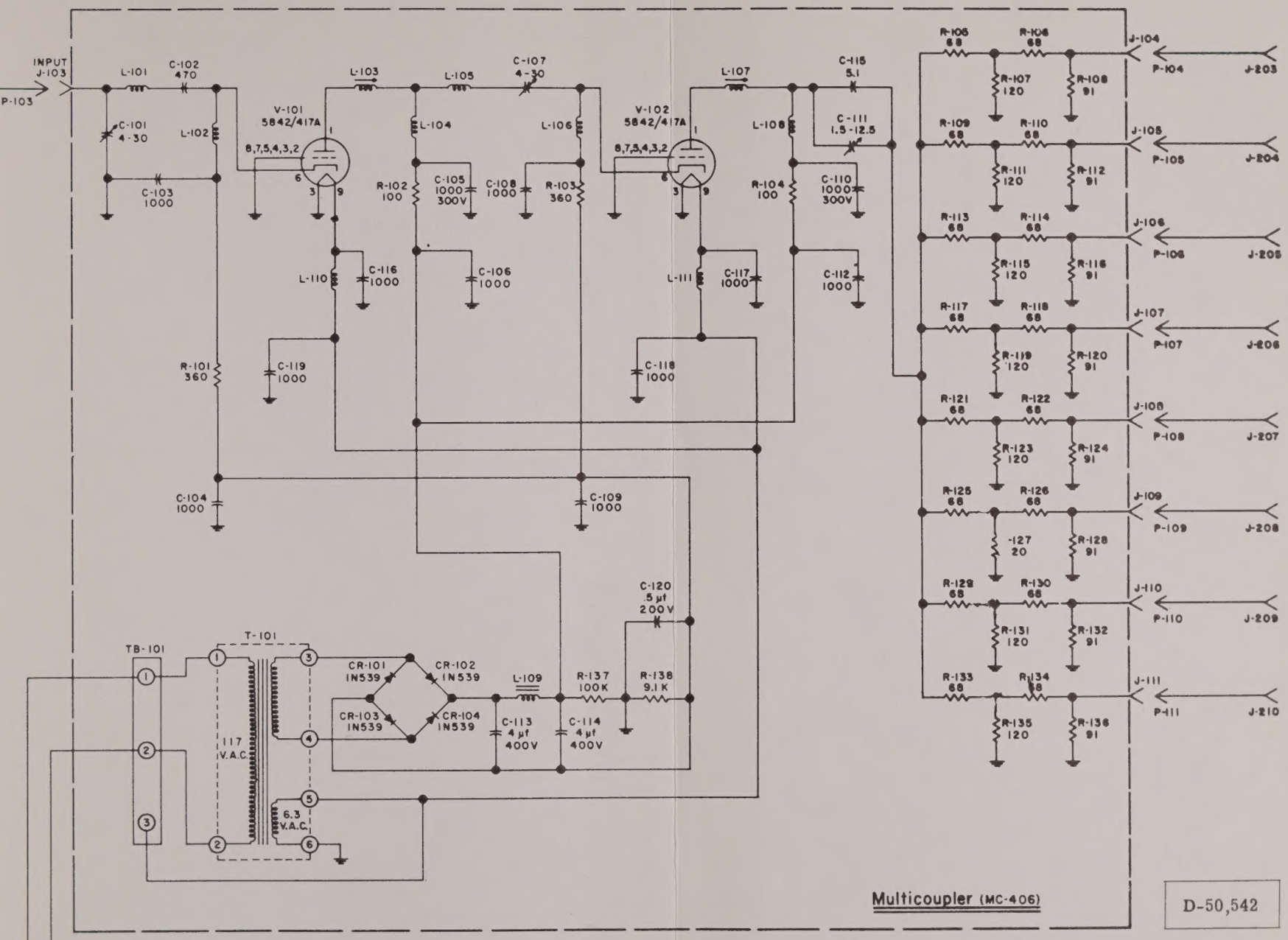
Symbol No.	Description	All Symbols Involved
PV-102	TUBE, ELECTRON: General Electric No. 7077	PV-102
PV-103	TUBE, ELECTRON: Type 5651, per MIL-E-1.	PV-103
PXV-101	SOCKET, ELECTRON TUBE: Cinch-Jones Type No. 14F14078.	PXV-101
PXV-102	SOCKET, ELECTRON TUBE: Grounded grid, Jettron No. 8670.	PXV-102
PXV-103	SOCKET, ELECTRON TUBE: 7 pin miniature, No. TS102P01.	PXV-103
	MULTICOUPLER COMPONENTS	
MC-101	CAPACITOR, CERAMIC, VARIABLE: 4-30 μμf, 500V, Type TS-2A, No. CV11C300 per MIL-C-81A.	MC-101, MC-107
MC-102	CAPACITOR, CERAMIC: 470 μμf ±10%, 500V, Erie Style 331	MC-102
MC-103	CAPACITOR, CERAMIC, STANDOFF: .001 μf, MRC, 500V, Sprague 507C2.	MC-103, MC-104, MC-106, MC-108, MC-109, MC-112, MC-116, MC-117, MC-118, MC-119
MC-104	Same as MC-103.	
MC-105	CAPACITOR, SILVER, MICA, BUTTON: 1000 μμf, ±10%, 300 WVDC, No. CB21PBD102K, per MIL-C-10950.	MC-105, MC-110
MC-106	Same as MC-103.	
MC-107	Same as MC-101.	
MC-108	Same as MC-103.	
MC-109	Same as MC-103.	
MC-110	Same as MC-105.	
MC-111	CAPACITOR, CERAMIC, VARIABLE: 1.5 -12.5 μμf, 500V, CTC, CST-50.	MC-111
MC-112	Same as MC-103.	
MC-113	CAPACITOR, PAPER: bathtub, 4 μf, ±20%, 400V, Astron MD-4-4M.	MC-113, MC-114
MC-114	Same as MC-113.	
MC-115	CAPACITOR, CERAMIC: 5.1 μμf, 500V, CC20CH5R1D per JAN-C-20A.	MC-115
MC-116	Same as MC-103.	
MC-117	Same as MC-103.	
MC-118	Same as MC-103.	
MC-119	Same as MC-103.	
MC-120	CAPACITOR, PAPER: 500,000 μμf, ±20%, 200V, Aerovox P123ZGP.	MC-120
MCR-101	RECTIFIER, DIODE, SILICON: Type No. 1N539, Raytheon.	MCR-101, MCR-102, MCR-103, MCR-104

Symbol No.	Description	All Symbols Involved
MCR-102	Same as MCR-101.	
MCR-103	Same as MCR-101.	
MCR-104	Same as MCR-101.	
MJ-103	CONNECTOR, RECEPTACLE: BNC, UG-1094/U	MJ-103, MJ-104, MJ-105, MJ-106, MJ-107, MJ-108, MJ-109, MJ-110 MJ-111
MJ-104	Same as MJ-103.	
MJ-105	Same as MJ-103.	
MJ-106	Same as MJ-103.	
MJ-107	Same as MJ-103.	
MJ-108	Same as MJ-103.	
MJ-109	Same as MJ-103.	
MJ-110	Same as MJ-103.	
MJ-111	Same as MJ-103.	
ML-101	INDUCTANCE, WIRE LEADS: No. 22 Buss wire (Item #212)	ML-101, ML-104, ML-105, ML-108
ML-102	INDUCTANCE, COIL: Per Nems-Clarke Co. Dwg. No. AA-17, 422	ML-102, ML-106, ML-110, ML-111
ML-103	INDUCTANCE, VARIABLE: Per Nems-Clarke Co. Dwg. No. AA-19, 887-1.	ML-103
ML-104	Same as ML-101.	
ML-105	Same as ML-101.	
ML-106	Same as ML-102.	
ML-107	INDUCTANCE, VARIABLE: Per Nems-Clarke Co. Dwg. No. AA-19, 887-2.	ML-107
ML-108	Same as ML-101.	
ML-109	INDUCTANCE, CHOKE ASSEMBLY: Per Nems-Clarke Co. Dwg. No. AB-17, 400	ML-109
ML-110	Same as ML-102.	
ML-111	Same as ML-102.	
MP-103	CONNECTOR, PLUG: Type BNC, UG-88/U	MP-103, MP-104, MP-105, MP-106, MP-107, MP-108, MP-109, MP-110, MP-111
MP-104	Same as MP-103.	
MP-105	Same as MP-103.	
MP-106	Same as MP-103.	

Symbol No.	Description	All Symbols Involved
MP-107	Same as MP-103.	
MP-108	Same as MP-103.	
MP-109	Same as MP-103.	
MP-110	Same as MP-103.	
MP-111	Same as MP-103.	
MR-101	RESISTOR, FIXED COMPOSITION: 360 ohms ±5%, 1/2W, RC20GF361J, per MIL-R-11A.	MR-101, MR-103
MR-102	RESISTOR, FIXED COMPOSITION: 100 ohms ±5%, 1/2W, RC20GF101J, per MIL-R-11A.	MR-102, MR-104
MR-103	Same as MR-101.	
MR-104	Same as MR-102.	
MR-105	RESISTOR, FIXED COMPOSITION: 68 ohms ±5%, 1/2W, RC20GF680J, per MIL-R-11A.	MR-105, MR-106, MR-109, MR-110, MR-113, MR-114, MR-117, MR-118, MR-121, MR-122, MR-125, MR-126, MR-129, MR-130, MR-133, MR-134
MR-106	Same as MR-105.	
MR-107	RESISTOR, FIXED COMPOSITION: 120 ohm ±5%, 1/2W, RC20GF121J, per MIL-R-11A.	MR-107, MR-111, MR-115, MR-119, MR-123, MR-127, MR-131, MR-135
MR-108	RESISTOR, FIXED COMPOSITION: 91 ohms ±5%, 1/2W, RC20GF910J, per MI L-R-11A.	MR-108, MR-112, MR-116, MR-120, MR-124, MR-128, MR-132, , R-136
MR-109	Same as MR-105.	
MR-110	Same as MR-105.	
MR-111	Same as MR-107.	
MR-112	Same as MR-108.	
MR-113	Same as MR-105.	
MR-114	Same as MR-105.	
MR-115	Same as MR-107.	
MR-116	Same as MR-108.	
MR-117	Same as MR-105.	
MR-118	Same as MR-105.	
MR-119	Same as MR-107.	
MR-120	Same as MR-108.	

Symbol No.	Description	All Symbols Involved
MR-121	Same as MR-105.	
MR-122	Same as MR-105.	
MR-123	Same as MR-107.	
MR-124	Same as MR-108.	
MR-125	Same as MR-105.	
MR-126	Same as MR-105.	
MR-127	Same as MR-107.	
MR-128	Same as MR-108.	
MR-129	Same as MR-105.	
MR-130	Same as MR-105.	
MR-131	Same as MR-107.	
MR-132	Same as MR-108.	
MR-133	Same as MR-105.	
MR-134	Same as MR-105.	
MR-135	Same as MR-107.	
MR-136	Same as MR-108.	
MR-137	RESISTOR, FIXED COMPOSITION: 100,000 ohms ±5%, 1/2W, RC20GF104J, per MIL-R-11A.	MR-137
MR-138	RESISTOR, FIXED COMPOSITION: 9100 ohms ±5%, 1/2W, RC-20GF912J, per MIL-R-11A.	MR-138
MT-101	TRANSFORMER, POWER: Assembly per Nems-Clarke Co. Dwg. AB-19,880.	MT-101
MTB-101	TERMINAL STRIP: Cinch Jones Part No. 3-140-Y	MTB-101
MV-101	TUBE, ELECTRON: Western Electric 5842/417A, per MIL-E-1.	MV-101, MV-102
MV-102	Same as MV-101	
MXV-101	SOCKET, ELECTRON TUBE: Mycalex Type 90A299.	MXV-101, MXV-102
MXV-102	Same as MXV-101.	


INPUT
J-202
J-103
P-103
L-101
V-101
6280/4168
L-105
L-107
C-108
6
V-102
7077
L-110
L-112
C-113
4.4
OUTPUT
J-104
P-104
C-101
.7-8
1800V
C-102
10
C-118
1000
L-102
L-103
L-104
L-106
L-108
L-109
L-111
C-109
1000
C-103
1000
R-101
160
R-108
5.6K
R-107
82K
C-107
1000
300V
R-103
680
1W
R-104
82
R-105
18K
2W
C-112
1000
300V
C-104
1000
C-105
1000
C-117
1000
C-106
1000
C-110
1000
C-111
1000
R-102
100
R-109
5.4
25W
T-101
TB-101
CR-101
CR-102
CR-103
CR-104
L-113
C-115
4 µf.
400V
C-116
4 µf.
400V
R-106
39K
1W
R-110
220K
1W, 10%
B-101
C-114
1.0 uf
400V
V-103
5651
Preamplifier (PR-203)
J-201
115 V.A.C.
60~
C-201
.005µf
L-201
3.1 µh
C-203
.001µf
C-202
.005µf
L-202
3.1 µh
C-204
.001µf
DS-201
S-201
F-201
.5 A
F-202
.2 A



NOTES:

1. ALL RESISTORS ARE FIXED, MEASURED IN OHMS, AND ARE 5%, 1/2 WATT UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE MEASURED IN µµf, AND ARE 500V UNLESS OTHERWISE SPECIFIED.

Figure 5-1.

Schematic Diagram, Model PM-406, Preamplifier-Multicoupler.